HP Tape Library & Autoloader Drive Manual

Edition 2

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For warranty information for your HP Tape Library or Autoloader, refer to your user's guide.

Revision History

New editions of this manual incorporate all material updated since the previous edition. The manual release date and part number indicate the current edition. The release date changes when a new edition is released. (Minor corrections and updates incorporated do not change this date.)

Edition 1:.	**December 2000: C7200-90090** Initial release.
Edition 2:.	**February 2001:** Added information on mixed media, a reference to the HP Library & Tape Tools media migration utility, additional DLT1 drive and media errors, and additional Ultrium bar code label graphics.

Typographical Conventions and Terms

Keycap: Menu choices within the HP Library & Tape Tools diagnostic utility.

WARNING **Warnings call attention to a procedure or practice that could result in personal injury if not correctly performed. Do not proceed until you fully understand and meet the required conditions.**

CAUTION Cautions call attention to an operating procedure or practice that could damage the product if not correctly performed. Do not proceed until you understand and meet these required conditions.

NOTE Notes explain significant concepts or operating instructions.

TIP Tips provide hints or shortcuts for a procedure.

Using this Manual

Hewlett-Packard Tape Libraries and Autoloaders support Quantum DLT 8000, Benchmark DLT1, and HP Ultrium drive technologies. This manual provides information on drives and media that will assist you in using, maintaining, and troubleshooting your product.

The following chapters are included in this manual:

Chapter 1	**Overview:** Provides a brief introduction to Quantum DLT, Benchmark DLT1, and HP Ultrium drives, media, compatibility, media migration, mixed media, and general precautions.
Chapter 2	**Quantum DLT Drives & Media:** Provides DLT drive and media specifications, using DLT media, and DLT drive troubleshooting information.
Chapter 3	**Benchmark DLT1 Drives & Media:** Provides DLT1 drive and media specifications, using DLT1 media, and DLT1 drive troubleshooting information.
Chapter 4	**HP Ultrium Drives & Media:** Provides Ultrium drive and media specifications, using Ultrium media, and Ultrium drive troubleshooting information.

Supported Drive Technologies

The following table lists Hewlett-Packard Tape Libraries and Autoloaders, and their supported drive technologies.

Model	Drive Technology
Tape Autoloader 1/9	• Quantum DLT 8000 • Benchmark DLT1 • HP Ultrium
Tape Library 2/20	• Quantum DLT 8000 • HP Ultrium
Tape Library 4/40	• Quantum DLT 8000 • HP Ultrium
Tape Library 6/60	• Quantum DLT 8000 • HP Ultrium
Tape Library 6/140	• Quantum DLT 8000 • HP Ultrium

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1 Overview

Drive Technologies and Compatibility

Format Compatibility

Table 1-1 shows read and write compatibility between Quantum DLT, Benchmark DLT1, and LTO, Linear Tape-Open, Ultrium formats.

Table 1-1 **Drive Format Compatibility**

Drive Type	Read-Compatible	Write-Compatible
DLT 8000	DLT 4000 DLT 7000 DLT 8000	DLT 4000 DLT 7000 DLT 8000
DLT1	DLT 4000 DLT1	DLT1
LTO Ultrium	LTO Ultrium	LTO Ultrium

Media Compatibility

CAUTION

It is critical to ensure that the media you use matches the format of your tape drive. Cleaning cartridges and formatted data cartridges are unique for each drive technology. Damage may occur if inappropriate media is used in the tape drives.

Table 1-2 shows drive technologies and compatible *unformatted* data cartridges.

Table 1-2 **Data Cartridge Compatibility (Unformatted)**

Drive Type	Data Cartridge Type
Quantum DLT	DLT Type IIIXT DLT Type IV
Benchmark DLT1	DLT Type IV
HP Ultrium	HP Ultrium 200 GB

Table 1-3 shows drive technologies and compatible cleaning cartridges.

Table 1-3 **Cleaning Cartridges**

Drive Type	Cleaning Cartridge Type
Quantum DLT	*DLTtape Cleaning Cartridge only*
Benchmark DLT1	*DLT1 Cleaning Cartridge only*
HP Ultrium	HP Ultrium Cleaning Cartridge IBM Ultrium Cleaning Cartridge

NOTE

Ensure you use the correct cleaning cartridge for your tape drive. (See “Using DLT Cleaning Cartridges” on page 2-11, “Using DLT1 Cleaning Cartridges” on page 3-12, and “Using Ultrium Cleaning Cartridges” on page 4-10.)

Mixed Media

HP Tape Libraries have a mixed media feature that allows the use of two different drive technologies in the same library. (See page -v for a list of libraries and the drive technologies they support.)

NOTE

Supported use models are described in detail in the *Mixed Media White Paper for the Network Administrator*. This document is available from www.hp.com/support/modularlibrary for tape library models 2/20, 4/40, and 6/60, and from www.hp.com/support/tapelibrary for model 12/140.

General considerations when using mixed media:

- Upgrade kits are available from HP for Ultrium tape drives, magazines, and tape cartridges.
- The same type of drive per level of the library is the only mixed media configuration supported by HP. This excludes tape library model 2/20 from a mixed media use model at this time.
- HP recommends maintaining the same magazine ratio as the drive ratio.
- In order to provide full mailslot support in a mixed media library, one magazine is required for each drive type for a total of 10 mailslots. Only DLT tapes can be used in a DLT magazine, and only Ultrium tapes can be used in an Ultrium magazine.
- HP Library & Tape Tools version 2.2 or greater is required for diagnostic support (see page 1-5).

Media Migration

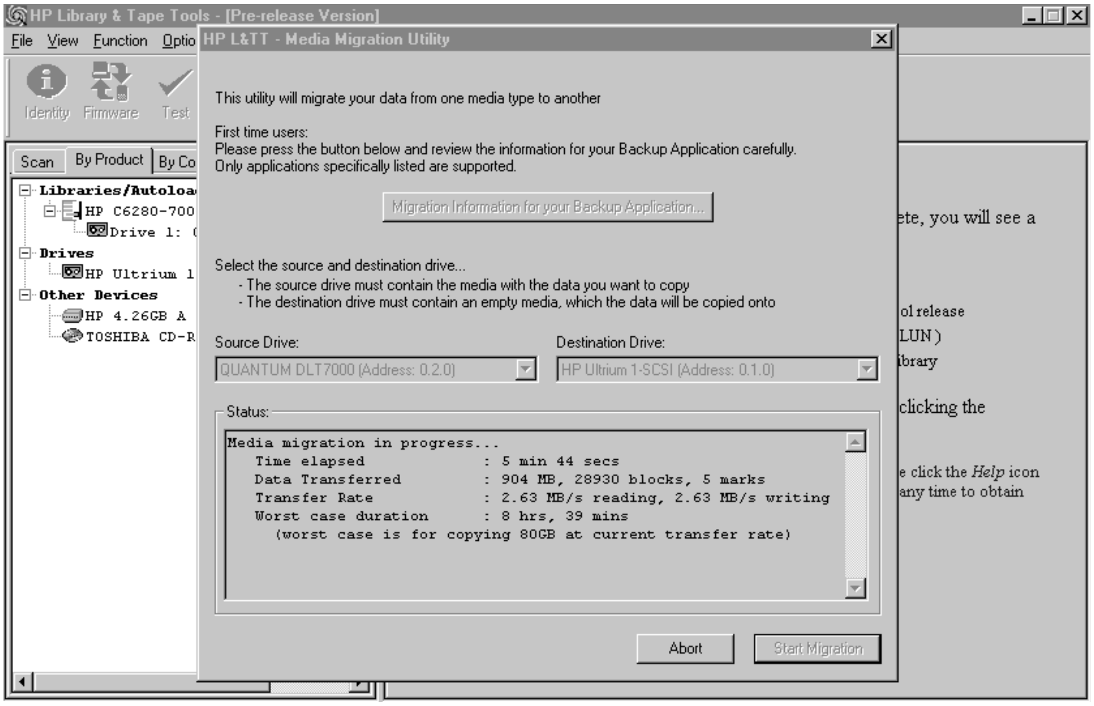
Utilities and services are available to assist you in migrating from one drive technology to another where possible.

HP Library & Tape Tools

The HP Library & Tape Tools diagnostic assists you in installing and supporting your tape library or autoloader. This tool provides an intuitive graphical user interface with integrated context-sensitive help. It can be downloaded free of charge from www.hp.com/support/tapetools.

Among the many features is a **Migrate Backup Media** option available from the **Utility** menu. This utility will copy data from DLT drives to DLT or Ultrium drives. See Figure 1-1 for a screen shot from HP Library & Tape Tools.

Figure 1-1 **HP L&TT Media Migration Utility**



This utility will migrate your data from one media type to another

First time users:
Please press the button below and review the information for your Backup Application carefully.
Only applications specifically listed are supported.

Select the source and destination drive...
- The source drive must contain the media with the data you want to copy
- The destination drive must contain an empty media, which the data will be copied onto

Source Drive: QUANTUM DLT7000 (Address: 0.2.0)

Destination Drive: HP Ultrium 1-SCSI (Address: 0.1.0)

Status:

```
Media migration in progress...
   Time elapsed            : 5 min 44 secs
   Data Transferred        : 904 MB, 28930 blocks, 5 marks
   Transfer Rate           : 2.63 MB/s reading, 2.63 MB/s writing
   Worst case duration     : 8 hrs, 39 mins
     (worst case is for copying 80GB at current transfer rate)
```

NOTE Before using the media migration utility in HP Library & Tape Tools, ensure that the source media is write-protected. This utility does not provide any library control. You must load media into the selected drives using the library or autoloader front panel, Web-Based Library Administrator, or your backup software utility.

For more information on using HP Library & Tape Tools for media migration, refer to www.hp.com/support/tapetools.

Service Provider

Vogon International provides migration, recovery, and forensic services with offices in the United Kingdom, Germany, and the United States. Vogon offers a standard service and a fast track service that generally has a 50% quicker turnaround time from the standard service. Prices vary depending on the complexity of the service requested.

Vogon International Ltd.

Web address:	www.vogon-international.com
Mailing address:	Talisman Business Centre Talisman Road Bicester, Oxfordshire OX6 OJX
Telephone:	United States: (405) 321 2585 UK: 44 (0) 1869 355255 Germany: 49 (0) 89 3235030

Electrostatic Discharge (ESD) and Other Precautions

Tape drives contain very sensitive electrical components. It is important to follow the proper procedures to prevent electrostatic discharge (ESD), which could result in damage to the product. Failure to take proper precautions could lead to intermittent failures or premature hard failures.

Use the following general precautions when handling tape drives:

- Use a properly installed anti-static mat on your work surface.
- Use properly fitted wrist-grounding straps.
- Be careful not to touch any PC board components.
- If installing the tape drive, always leave it in its anti-static bag until you are ready to install it.
- Place the tape drive on a properly grounded anti-static work surface when it is out of its protective anti-static bag.
- Do not use the bag as a substitute for the work surface anti-static mat. The outside of the bag may not have the same anti-static properties as the inside.
- When removing or replacing the tape drive, never rest it on its front bezel (the side containing the drive door where tapes are inserted).
- Do not place hands or foreign objects inside the tape drive’s door or drive bay, or touch internal components. Skin oils will damage the recording heads.

Use the following general precautions when handling tape cartridges:

- Do not carry cartridges loosely in a container that exposes them to unnecessary physical shock. Dropping or bumping cartridges may dislodge and damage internal components.
- Store each cartridge vertically in its protective case until needed.
- Do not allow direct contact with the tape medium or open the tape door unnecessarily. Dust or skin oils can contaminate the tape and impact performance.
- Do not place cartridges on or near devices that may produce strong magnetic fields. Such exposure may alter or erase data on the tape.
- Do not expose the cartridge to moisture or direct sunlight.

2 Quantum DLT Drives & Media

Chapter Overview

This chapter describes the following:

- DLT Drive and Media Specifications
- Using DLT Tape Cartridges
- Troubleshooting DLT Drives

DLT Drive and Media Specifications

Table 2-1 **DLT Drive Specifications**

Description	**Quantum DLT 8000**
Performance	
Read/write transfer rate: maximum sustained (DLT Type IV media)	• Non-compressed mode: 6.0 MB/second • Compressed (2:1 typical): 12.0 MB/second
Burst transfer rate	20 MB/second
Average access time	60 seconds
Loading time to BOT (for previously written tape)	37 seconds (average)
Unloading time from BOT	17 seconds (average)
MTBF	250,000 hours
Interface type	• Low-Voltage Differential (LVD) Fast wide SCSI • High-Voltage Differential (HVD) Fast wide SCSI

Table 2-2 **DLT Media Specifications**

Characteristic	DLT Type IV Media
Formatted capacity	*DLT 8000 format:* • 40 GB (non-compressed) • 80 GB (2:1 typical compression)
Basic description	0.5 inch (metal particle)
Tape length	557 meters (1828 feet)
Cartridge dimensions	10.4 x 10.4 x 2.5 cm (4.1 x 4.1 x 1.0 in)
Shelf life	30 years (minimum) @ 20° C 40% RH (non-condensing)
Cartridge life	• 1,000,000 passes (any point on the tape passing the recording head in either direction) • 2,000 loads/unloads
Cleaning cartridge life	20 uses

NOTE You can also use DLT Type IIIXT media, though it has a significantly reduced capacity and performance compared to DLT Type IV media.

Using DLT Tape Cartridges

CAUTION Quantum DLT tape drives require special cleaning cartridges and data cartridges formatted specifically for Quantum DLT. To avoid damage to your tape drive, it is critical to use appropriate DLT cleaning cartridges and properly formatted DLT data cartridges.

This section describes the following:

- Inspecting DLT Cartridges
- Write-Protecting DLT Cartridges
- Using DLT Cartridge Bar Code Labels
- Loading DLT Cartridges into a Magazine
- Using DLT Cleaning Cartridges

In addition to the information provided in this manual, refer to the documentation provided with your DLT media for more information.

NOTE Quantum DLT tape drives use DLT Type IV media. Though the unformatted media cartridges for Quantum DLT and Benchmark DLT1 are the same, the DLT format is unique. DLT1 formatted cartridges are not useable in Quantum DLT tape drives. (See “Format Compatibility” on page 1-2.)

Inspecting DLT Cartridges

NOTE Make it a practice to visually inspect your tape cartridges when removing or loading them into your tape library or autoloader. Taking a few minutes to check the condition of the cartridges will lower the risk of repeated failures and help ensure uninterrupted backup.

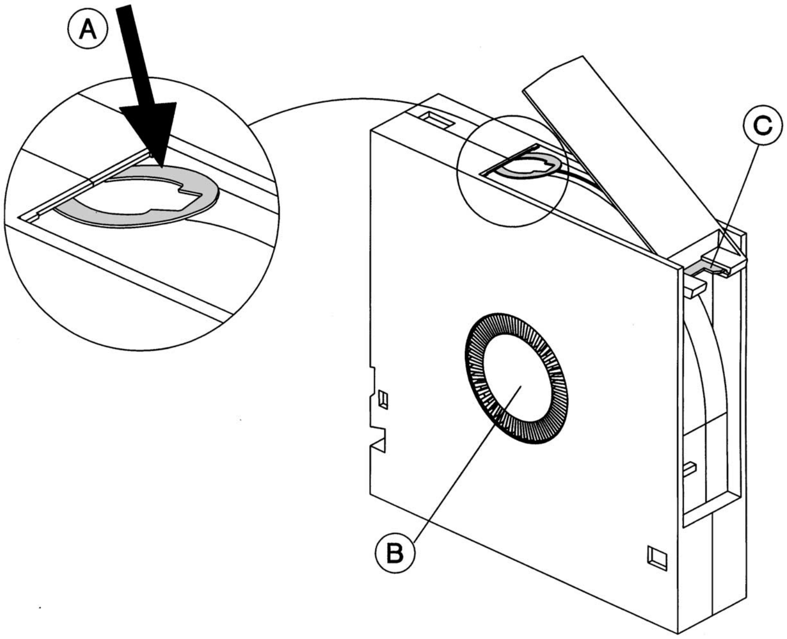
Repeated drive failures may indicate defective tapes. Tapes need to be inspected and replaced if they have been dropped, damaged, or used with a failed drive. To determine if the tapes have been damaged:

- Gently shake the tape cartridge to verify that no internal parts are rattling.
- Visually inspect the tape for a broken, unseated, or misaligned tape leader (item A in Figure 2-1 on page 2-7).

  To check the leader position:

  1. Press in the door lock (item C in Figure 2-1) to release the cartridge door.
  2. While pressing in the door lock, push the tab down to open the door. Be careful not to touch the tape after opening the door.
- Verify that the spring-loaded hub (item B in Figure 2-1 on page 2-7) is centered within the circular opening on the bottom of the tape cartridge. Gently press the hub and make sure that it springs back into place.

Figure 2-1 **Leader in Correct Position, Hub, and Door Lock Tab**



A	Tape leader
B	Spring-loaded hub
C	Door lock

Do NOT Use DLT Cartridges with:

- Tape or leaders that have been touched with bare fingers (may transfer oils to the tape head).
- Labels used on the top, bottom, sides, or back of the cartridge. Use the label slot only.

CAUTION Always discard damaged tape cartridges. If a defective tape cartridge is loaded into a tape drive, it may in turn damage the drive, potentially requiring drive replacement.

Write-Protecting DLT Cartridges

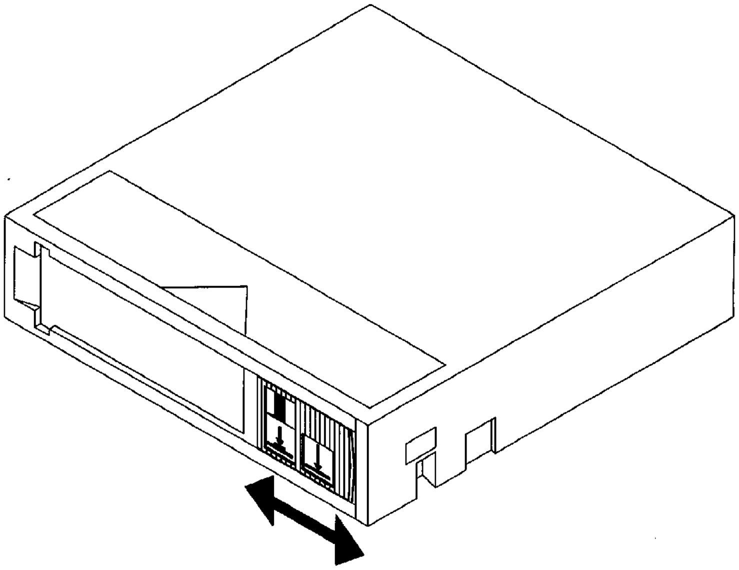
Each cartridge has a sliding write-protect switch. Using the write-protect switch ensures data safety for files that have been previously written to tape, preventing additional files from being written to that tape.

To change the write-protect setting, move the write-protect switch (Figure 2-2):

- **Left** to *prevent* data from being written to the cartridge. The orange indicator on the cartridge can be seen when the write-protect switch is in the “ON” position.
- **Right** to *allow* data to be written to the cartridge. The orange indicator on the cartridge cannot be seen when the write-protect switch is in the “OFF” position.

NOTE With the write-protect switch in either position, data can be read from the cartridge.

Figure 2-2 **DLT Write-Protect Button Settings**



Using DLT Cartridge Bar Code Labels

Make it a practice to use bar code labels on your tape cartridges. Your host software may need to keep track of the following information and the associated bar code:

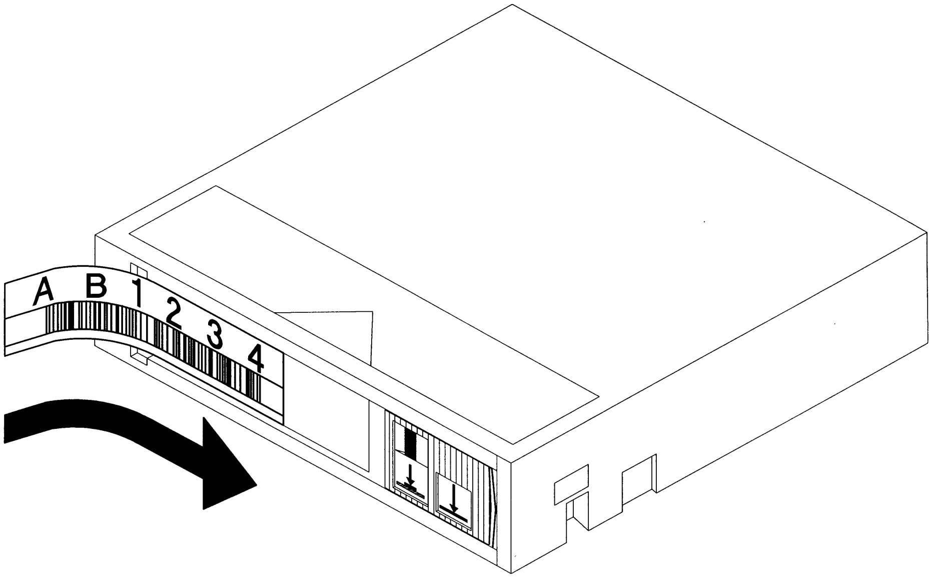
- Date of format or initialization
- Cartridge owner (such as a group or department)
- Storage purpose

TIP If the host software does not keep track of this information, create a method for doing so.

DLT cartridges have a front slide slot located on the face of the cartridge next to the write-protect switch. Use this slot for inserting the bar code label by sliding it into the slot (Figure 2-3).

CAUTION Do not apply labels onto the top, bottom, sides, or back of the cartridge as this may cause damage to the tape drive or interfere with reliable operation.

Figure 2-3 **Proper DLT Label Position**



DLT Cartridge Bar Code Specifications

Description	Specification
Data Cartridge Message	6-character: 2 alpha, 4 numeric, (AAnnnn)
Cleaning Cartridge Message	6-character: ‘CLN’, 3 numeric (CLNnnn)
Dimensions	5.6 cm x 2.1 cm (2.2 in x .82 in)
Symbology	code 39 without check digit
Start/Stop Characters	*/*
Narrow Bar	0.036 cm (0.014 in)
Ratio	2.5:1
Print Quality	ANSI Grade “A”

NOTE You can order additional bar codes if needed. Bar code ordering information is provided with your tape library or autoloader.

Using DLT Cleaning Cartridges

DLT drives should only be cleaned if the *clean drive* icon displays on the tape library or autoloader status bar. Only use the appropriate DLT cleaning cartridges and follow the instructions in your tape library or autoloader user's guide. In general, replace DLT cleaning cartridges after twenty uses. Marking the label on the cleaning cartridge after each use will help you keep track of the number of uses.

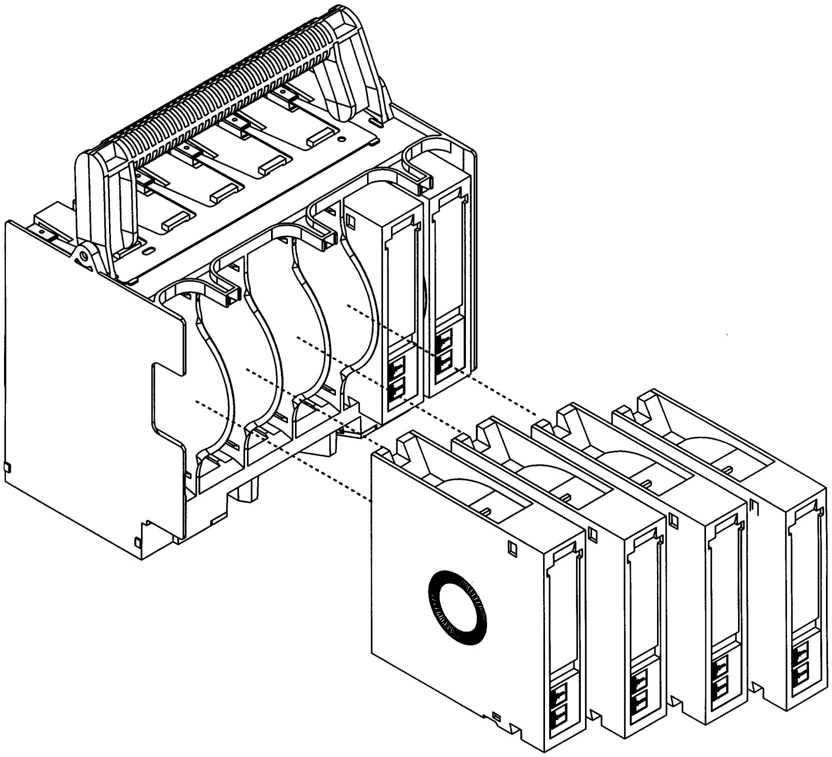
CAUTION Excessive use of the cleaning cartridge can cause unnecessary wear on the drive head. The tape library or autoloader front panel will display a message when the DLT cleaning cartridge needs to be replaced.

See "DLT Cleaning Issues" on page 2-16 for information on troubleshooting common cleaning problems.

Loading DLT Cartridges into a Magazine

When inserting DLT cartridges into the tape library or autoloader magazine, ensure that each cartridge is positioned with the write-protect switch facing out of the magazine and away from the magazine handle (Figure 2-4). Push the tape into the slot until it “clicks” into place.

Figure 2-4 **Loading DLT Tapes into a Magazine**



NOTE The six-slot magazine depicted in Figure 2-4 is for an autoloader. The tape library magazine has five slots.

Troubleshooting DLT Drives

This section describes the procedures for troubleshooting DLT drives, including:

- Manually Rewinding a Stuck Tape
- Removing a Stuck Tape
- DLT Cleaning Issues
- Media Issues

Refer to your tape library or autoloader user’s guide for information on troubleshooting performance issues or other problems you may encounter. If you experience problems not covered by these manuals, contact your support representative.

NOTE For information on upgrading drive firmware, see your tape library or autoloader user’s guide.

Manually Rewinding a Stuck Tape

NOTE Before manually rewinding a stuck tape, attempt to eject the tape using the tape library or autoloader front panel, remote management card Web-Based Library Administrator pages, and your host backup software.

Before manually rewinding a stuck tape, you must first remove the drive module from the tape library or autoloader. Refer to “Removing a Drive Module” in your tape library or autoloader user’s guide.

After removing the drive module, view the drive hub through the clear plastic to determine if the tape has been rewound. If the tape has not been rewound, follow the steps below and refer to Figure 2-5 on page 2-14:

CAUTION The DLT drive does not automatically eject a cartridge if a power failure occurs.

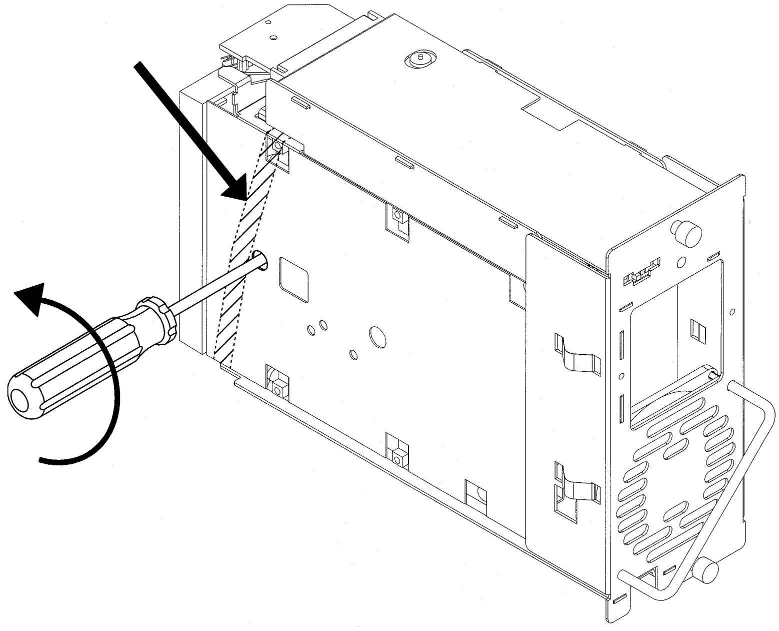
1. Place the DLT drive module on its top side so that the bottom of the drive module is facing up.
2. Insert a Phillips #2 screwdriver in the rewind hole on the bottom of the drive module and engage the screw.

NOTE Gently move the ribbon cable to one side of the rewind hole if necessary.

3. Turn the screwdriver counter-clockwise to rewind the tape. Continue rewinding until the leader is seated in the tape cartridge.

CAUTION Do not use a power screwdriver as damage may result to the tape.

Figure 2-5 **Rewinding a Tape in the DLT Drive Module**



Removing a Stuck Tape

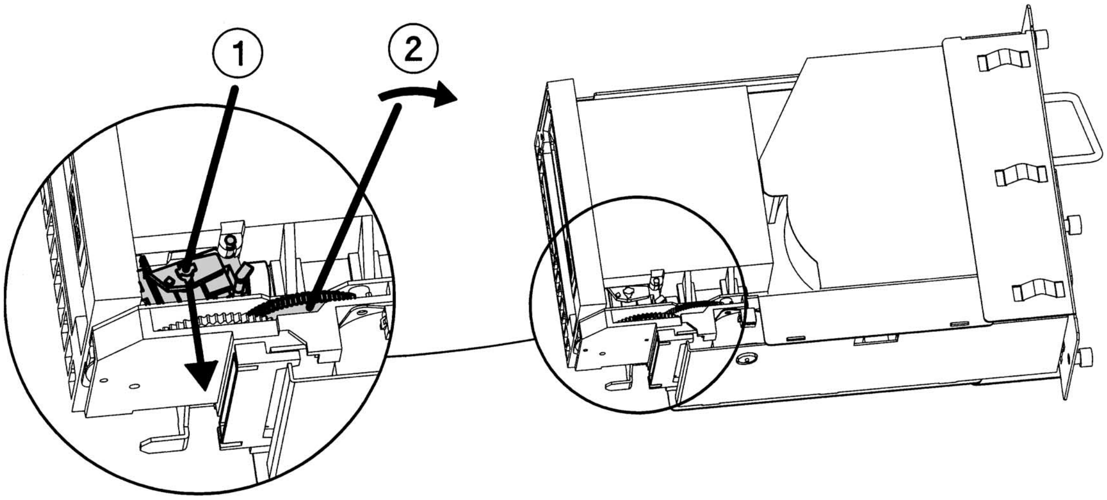
Use the following procedure and Figure 2-6 to remove a tape stuck in a DLT drive module:

1. Locate the spring-loaded latch near the opening on the drive module, and push it outward (item 1 in Figure 2-6). Ensure that you move both parts of the latch.
2. While holding the latch outward, rotate the thumb-wheel (drive gear) until the tape ejects (item 2 in Figure 2-6).

NOTE If turning the thumb-wheel does not eject the tape, or if you encounter high resistance in turning the thumb-wheel, check to ensure that the spring-loaded latch has been rotated outward.

3. Verify the tape is not damaged (see “Inspecting DLT Cartridges” on page 2-6).

Figure 2-6 **Spring-Loaded Latch and Thumb-Wheel**



DLT Cleaning Issues

Table 2-3 describes situations you may encounter with cleaning cartridges and how to resolve them.

Table 2-3 **DLT Cleaning Issues**

Problem	Solution
Recurring cleaning message.	• If the message reappears after cleaning the drive, the front panel display will indicate the need to replace the cleaning cartridge. • Replace the existing cleaning cartridge with a new one. • If the message reappears when a particular data cartridge is used, verify that the data cartridge is readable by: — Clearing the error message. — Reading the tape again. • If the data cartridge can be read, backup data from the damaged cartridge to another cartridge, and discard the damaged one.
A brand new data cartridge is used and the *clean drive* icon is displayed.	• Clean the outside of the data cartridge using a damp cloth. • Clean the drive using the drive cleaning procedure in your tape library or autoloader user's guide. • If the icon is displayed again within a short amount of time, replace the data cartridge.
Cannot load the cleaning cartridge.	• Ensure the cleaning cartridge matches your drive type. Cleaning cartridges are unique for each drive technology.

Media Issues

Table 2-4 describes situations you may encounter with media and how to resolve them.

Table 2-4 **Media Issues**

Problem	Solution
Cannot load tape into drive.	Ensure your media and format type matches your drive type. (See “Using DLT Tape Cartridges” on page 2-5.)
Tape has circular wear patterns around the hub.	The drive hub may not be engaging the tape hub properly. Discard the tape and contact your support representative.
Error message appears: “Drive rejected load of tape” (error code 101, qualifier 65 H).	Retry the operation. If you continue to get this error, replace the tape cartridge. If data recovery is needed, contact your support representative.

3

Benchmark DLT1 Drives & Media

Chapter Overview

This chapter describes the following:

- DLT1 Drive and Media Specifications
- Using DLT1 Tape Cartridges
- Troubleshooting DLT1 Tape Drives

DLT1 Drive and Media Specifications

Table 3-1 **DLT1 Drive Specifications**

Description	Benchmark DLT1
Performance	
Read/write transfer rate: maximum sustained (DLT Type IV media)	• Non-compressed mode: 3.0 MB/second • Compressed (2:1 typical): 6.0 MB/second
Burst transfer rate	20 MB/second
Average access time	68 seconds
Loading time to BOT (for previously written tape)	59 seconds (average)
Unloading time from BOT	17 seconds (average)
MTBF	200,000 hours
Interface type	Low-Voltage Differential (LVD) Ultra Wide SCSI

Table 3-2 **DLT1 Media Specifications**

Characteristic	DLT Type IV Media
DLT1 formatted capacity	• 40 GB (non-compressed • 80 GB (2:1 typical compression)
Basic description	0.5 inch (metal particle)
Tape length	557 meters (1828 feet)
Cartridge dimensions	10.4 x 10.4 x 2.5 cm (4.1 x 4.1 x 1.0 in)
Shelf life	30 years minimum @ 20° C 40% RH (non-condensing)
Cartridge life	1,000,000 passes (any point on the tape passing the recording head in either direction)
Cleaning cartridge life	20 uses

Using DLT1 Tape Cartridges

CAUTION

Benchmark DLT1 tape drives require special cleaning cartridges and data cartridges formatted specifically for DLT1. To avoid potential damage to your tape drive, it is critical to use appropriate DLT1 cleaning cartridges and properly formatted DLT1 data cartridges.

This section describes the following:

- Using DLT Type IV Media
- Inspecting DLT1 Cartridges
- Write-Protecting DLT1 Cartridges
- Using DLT1 Cartridge Bar Code Labels
- Loading DLT1 Cartridges into a Magazine
- Using DLT1 Cleaning Cartridges

In addition to the information provided in this manual, refer to the documentation provided with your DLT1 media for more information.

NOTE

Benchmark DLT1 tape drives use DLT Type IV media. Though the unformatted media cartridges for Quantum DLT and Benchmark DLT1 are the same, the DLT1 format is unique. Benchmark DLT1 tape drives cannot read or write to DLT 7000 and 8000 formatted cartridges, but they can read DLT 4000 formatted cartridges. (See “Format Compatibility” on page 1-2.)

Using DLT Type IV Media

CAUTION Always remove the cartridge from your DLT1 drive before powering down your tape library or autoloader. Leaving a cartridge in the drive when power is off can result in cartridge and drive damage. To prolong cartridge life, always return the cartridge to its storage case after removing it from the drive.

To ensure the most reliable operation when storing your data, HP recommends that you use new unformatted DLT Type IV cartridges or DLT Type IV cartridges that have been used only in DLT1 drives. If you want to write to cartridges that were previously formatted with a Quantum DLT drive, you must use a sufficiently rated bulk eraser to prepare the cartridges for use with your Benchmark DLT1 drive. (See page 1-2 for information on format compatibility.)

Bulk Erasing Tape Cartridges

Erasing the data cartridge in its original drive is not adequate because the existing, incompatible format will remain on the tape cartridge. The degaussing equipment used to bulk erase previously formatted media must have an Oersted rating at least equal to, and preferably two or three times greater than, the rating for the media being erased. For example, DLT Type IV media is rated at 1850 Oersteds. Specific procedures for degaussing your media should be included with your degaussing equipment.

The following websites offer degaussing products or services. Other sources can being found by doing an Internet search.

- www.audiolabelectronics.com/Degserv.htm
- www.datadev.com
- www.datasecurityinc.com/products.htm
- www.weircliffe.co.uk

CAUTION All previously recorded data will be removed if you bulk erase a tape cartridge.

NOTE If you experience any failures with reused Quantum DLT formatted (degaussed) cartridges, the degaussing may not have been sufficient to fully erase the data. If this happens, use another piece of media (preferably a new, unformatted DLT Type IV cartridge) before suspecting other system components.

Inspecting DLT1 Cartridges

NOTE Make it a practice to visually inspect your tape cartridges when removing or loading them into your tape library or autoloader. Taking a few minutes to check the condition of the cartridges will lower the risk of repeated failures and help ensure uninterrupted backup.

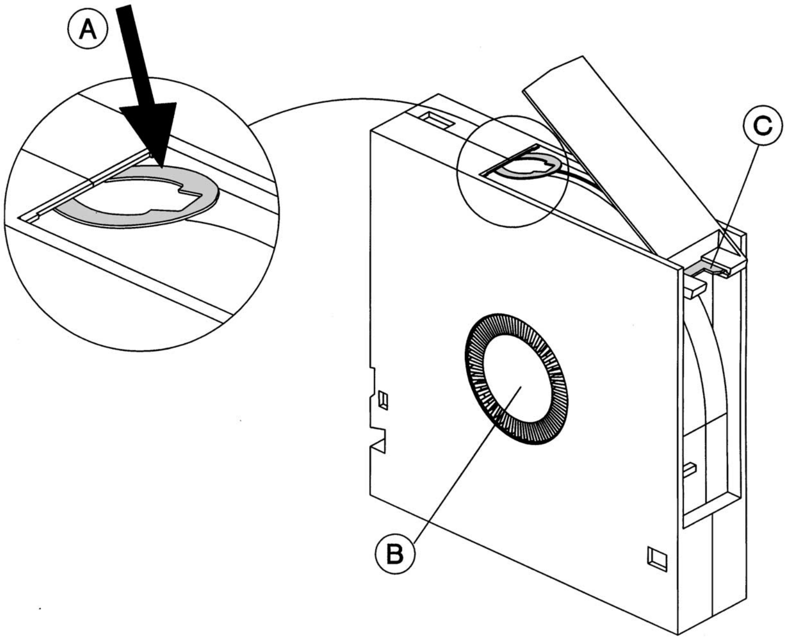
Repeated drive failures may indicate defective tapes. Tapes need to be inspected and replaced if they have been dropped, damaged, or used with a failed drive. To determine if the tapes have been damaged:

- Gently shake the tape cartridge to verify that no internal parts are rattling.
- Visually inspect the tape for a broken, unseated, or misaligned tape leader (item A in Figure 3-1 on page 3-8).

  To check the leader position:

  1. Press in the door lock (item C in Figure 3-1) to release the cartridge door.
  2. While pressing in the door lock, push the tab down to open the door. Be careful not to touch the tape after opening the door.
- Verify that the spring-loaded hub (item B in Figure 3-1 on page 3-8) is centered within the circular opening on the bottom of the tape cartridge. Gently press the hub and make sure that it springs back into place.

Figure 3-1 **Leader in Correct Position, Hub, and Door Lock Tab**



A	Tape leader
B	Spring-loaded hub
C	Door lock

Do NOT Use DLT1 Cartridges with:

- Tape or leaders that have been touched with bare fingers (may transfer oils to the tape head).
- Labels used on the top, bottom, sides, or back of the cartridge. Use the label slot only.

CAUTION Always discard damaged tape cartridges. If a defective tape cartridge is loaded into a tape drive, it may in turn damage the drive, potentially requiring drive replacement.

Write-Protecting DLT1 Cartridges

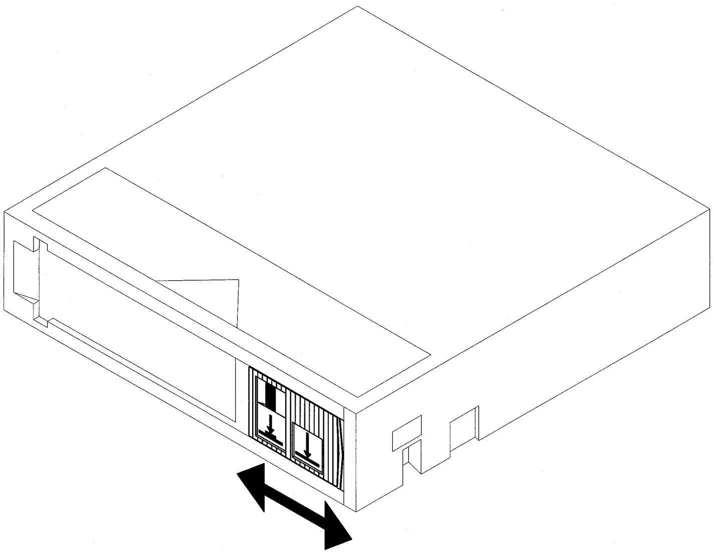
Each cartridge has a sliding write-protect switch. Using the write-protect switch ensures data safety for files that have been previously written to tape, preventing additional files from being written to that tape.

To change the write-protect setting, move the write-protect switch (Figure 3-2):

- **Left** to *prevent* data from being written to the cartridge. The orange indicator on the cartridge can be seen when the write-protect switch is in the “ON” position.
- **Right** to *allow* data to be written to the cartridge. The orange indicator on the cartridge cannot be seen when the write-protect switch is in the “OFF” position.

NOTE With the write-protect switch in either position, data can be read from the cartridge.

Figure 3-2 **DLT1 Write-Protect Button Settings**



Using DLT1 Cartridge Bar Code Labels

Make it a practice to use bar code labels on your tape cartridges. Your host software may need to keep track of the following information and the associated bar code:

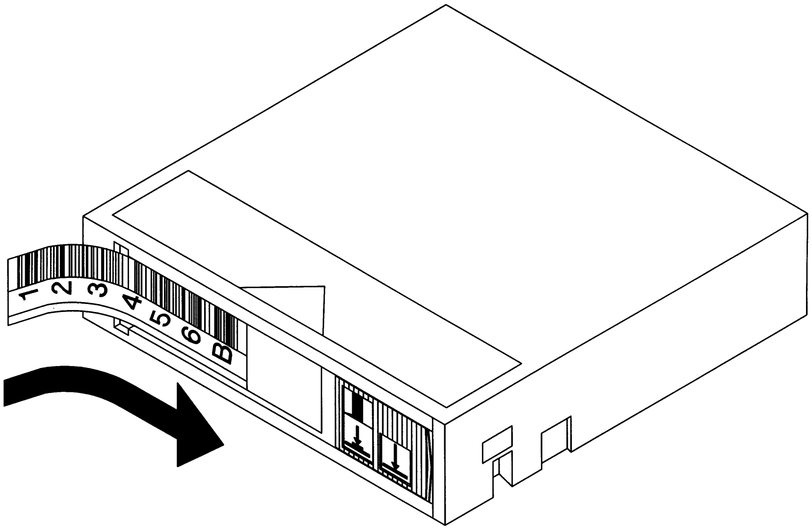
- Date of format or initialization
- Cartridge owner (such as a group or department)
- Storage purpose

TIP If the host software does not keep track of this information, create a method for doing so.

DLT1 cartridges have a front slide slot located on the face of the cartridge next to the write-protect switch. Use this slot for inserting the bar code label by sliding it into the slot (Figure 3-3).

CAUTION The bar code label should be applied as shown in Figure 3-3 with the alphanumeric portion facing the hub side of the tape cartridge. Do not apply labels onto the top, bottom, sides, or back of the cartridge as this may cause damage to the tape drive or interfere with reliable operation.

Figure 3-3 **Proper DLT1 Label Position**



NOTE You can order additional bar codes if needed. Bar code ordering information is provided with your tape library or autoloader.

Table 3-3 **DLT1 Bar Code Specifications**

Description	Specification
Data Cartridge Message	7-character: 6 alphanumeric (user preference) followed by 1 alpha (any combination of alpha or numeric with an ending character of B)
Cleaning Cartridge Message	7-character: ‘CLN’, 3 numeric, 1 alpha (CLNnnnA)
Dimensions	5.6 cm x 2.1 cm (2.2 in x .82 in)
Symbology	code 39 without check digit
Start/Stop Characters	*/*
Narrow Bar	0.036 cm (0.014 in)
Ratio	2.5:1
Print Quality	ANSI Grade “A”

NOTE For data and cleaning cartridge messages, ‘n’ represents the volume serial number (or volser), and ‘A’ represents the media ID. The Benchmark (DLT1) DLT Type IV media ID is ‘B’.

Using DLT1 Cleaning Cartridges

DLT1 drives should be cleaned when the *clean drive* icon displays on the tape library or autoloader status bar. Only use the appropriate DLT1 cleaning cartridges and follow the instructions in your tape library or autoloader user’s guide. In general, replace DLT1 cleaning cartridges after twenty uses. Marking the label on the cleaning cartridge after each use will help you keep track of the number of uses.

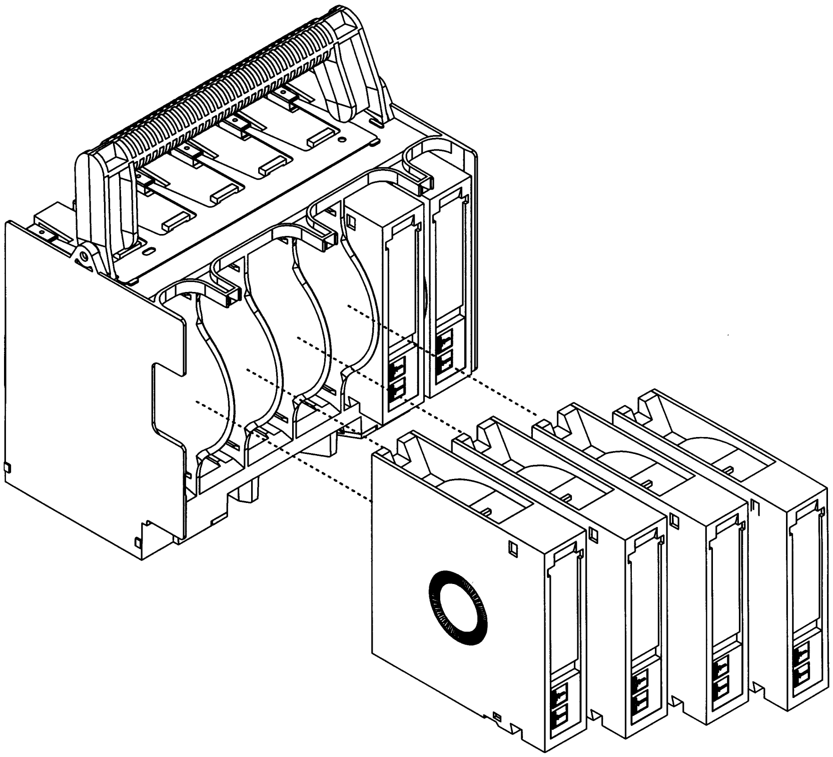
NOTE The tape library or autoloader front panel will display a message when the DLT1 cleaning cartridge needs to be replaced.

See “DLT1 Cleaning Issues” on page 3-15 for information on troubleshooting common cleaning problems.

Loading DLT1 Cartridges into a Magazine

When inserting DLT1 cartridges into the tape library or autoloader magazine, ensure that each cartridge is positioned with the write-protect switch facing out of the magazine and away from the magazine handle (Figure 3-4). Push the tape into the slot until it “clicks” into place.

Figure 3-4 **Loading DLT1 Tapes into a Magazine**



NOTE

The six-slot magazine depicted in Figure 3-4 is for an autoloader. The tape library magazine has five slots.

Troubleshooting DLT1 Tape Drives

This section describes troubleshooting information for DLT1 drives, including:

- Rewinding/Removing a Stuck Tape
- DLT1 Cleaning Issues
- Media Compatibility Issues
- Miscellaneous Issues

Refer to your tape library or autoloader user's guide for information on troubleshooting performance issues or other problems you may encounter. If you experience problems not covered in this manual, contact your support representative.

NOTE For information on upgrading drive firmware, see your tape library or autoloader user's guide.

Rewinding/Removing a Stuck Tape

If a tape gets stuck in the drive, attempt to eject the tape using:

- Tape library or autoloader front panel
- Remote management card Web-Based Library Administrator pages
- Host backup software

If these attempts are not successful, contact your support representative.

DLT1 Cleaning Issues

Table 3-4 describes potential issues with cleaning cartridges and how to resolve them.

Table 3-4 **DLT1 Cleaning Issues**

Problem	Solution
Recurring cleaning message.	• If the message reappears after cleaning the drive, the front panel display will indicate the need to replace the cleaning cartridge. • Replace the existing cleaning cartridge with a new one. • If the message reappears when a particular data cartridge is used, verify that the data cartridge is readable by: — Clearing the error message. — Reading the tape again. • If the data cartridge can be read, backup data from the damaged cartridge to another cartridge, and discard the damaged one.
A brand new data cartridge is used and the *clean drive* icon is displayed.	• Clean the outside of the data cartridge using a damp cloth. • Clean the drive using the drive cleaning procedure in your tape library or autoloader user's guide. • If the icon is displayed again within a short amount of time, replace the data cartridge.
Cannot load the cleaning cartridge.	• Ensure the cleaning cartridge matches your drive type. Cleaning cartridges are unique for each drive technology.

Media Compatibility Issues

Table 3-5 lists potential error messages and what may cause them.

Table 3-5 **Media Compatibility Issues**

Message	Cause
Media format invalid for drive type.	An attempt was made to load incompatible media into a DLT1 tape drive. Ensure your media and format is compatible with a DLT1 tape drive. (See "Using DLT1 Tape Cartridges" on page 3-5.)
Media is write protected - restore from tape successful.	Media with the DLT 4000 format was loaded into a DLT1 tape drive. The data is readable but the media must be bulk erased before a DLT1 tape drive can write to this tape. (See "Bulk Erasing Tape Cartridges" on page 3-6.)
Media is write protected - restore from tape NOT successful.	An attempt was made to load media with a DLT 7000 or 8000 format into a DLT1 tape drive. The format is incompatible and the data cannot be read. The media must be degaussed before a DLT1 tape drive can write to this tape. (See "Bulk Erasing Tape Cartridges" on page 3-6.)

NOTE If you experience any failures with reused Quantum DLT formatted (degaussed) cartridges, the degaussing may not have been sufficient to fully erase the data. If this happens, use another piece of media (preferably a new, unformatted DLT Type IV cartridge) before suspecting other system components.

Miscellaneous Issues

Table 3-6 lists some miscellaneous issues that you may encounter and their potential causes. If you continue to have problems resolving these issues, contact your service representative for further assistance.

Table 3-6 **Miscellaneous Issues**

Issue	Cause
Receive 'media invalid for drive type' error. Message is cleared when navigating through the front panel menu tree. The autoloader goes back into a ready state, though the drive is still not ready.	The autoloader was in random mode and incompatible media was loaded into the drive. Ensure your media and format is compatible with a DLT1 tape drive. (See "Using DLT1 Tape Cartridges" on page 3-5.)
Drive continuously loads and unloads media.	Incompatible media was loaded into the drive. Ensure your media and format is compatible with a DLT1 tape drive. (See "Using DLT1 Tape Cartridges" on page 3-5.)
Autoloader reports a partial availability state.	Incompatible media may have been loaded into the drive. Ensure your media and format is compatible with a DLT1 tape drive. (See "Using DLT1 Tape Cartridges" on page 3-5.) **NOTE:** There are additional causes for the partial availability state relating to your autoloader's configuration. Refer to your autoloader user's guide for more information.

4 HP Ultrium Drives & Media

Chapter Overview

This chapter describes the following:

- HP Ultrium Drive and Media Specifications
- Using HP Ultrium Cartridges
- Troubleshooting HP Ultrium Drives

HP Ultrium Drive and Media Specifications

Table 4-1 **Ultrium Drive Specifications**

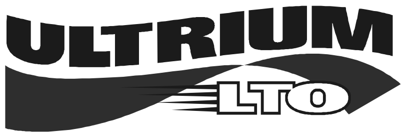
Description	**HP Ultrium**
Performance	
Read/write transfer rate: (maximum sustained)	• Non-compressed mode: 15 MB/second • Compressed (2:1 typical): 30 MB/second
Burst transfer rate	80 MB/second
Average access time	90 seconds
Loading time	25 seconds (maximum)
Unloading time	13 seconds (maximum)
MTBF	250,000 hours
Interface type	• Low-Voltage Differential (LVD) Ultra 2 SCSI • High-Voltage Differential (HVD) Ultra SCSI

Table 4-2 **Ultrium Media Specifications**

Characteristic	Ultrium Media
Formatted capacity	200 GB (2:1 typical compression)
Basic description	0.5 inch (metal particle)
Tape length	580 meters (1903 feet)
Cartridge dimensions	10.2 x 10.5 x 2.2 cm (4.02 x 4.15 x 0.85 in)
Shelf life	30 years
Cartridge life	• 1,000,000 passes • 20,000 loads/unloads
Cleaning cartridge life	15 uses

NOTE Only use approved Ultrium cleaning cartridges with HP Ultrium tape drives (see page 1-3). For data cartridges, only use those specificed as having met Ultrium standards. Approved media will have the Ultrium format trademark (Figure 4-1), which indicates that the media has passed Ultrium format compliance testing. For best results, always use HP branded media.

Figure 4-1 **Ultrium Format Trademark**



Using HP Ultrium Cartridges

CAUTION HP Ultrium tape drives require special cleaning cartridges and data cartridges formatted specifically for HP Ultrium. To avoid damage to your tape drive, it is critical to use appropriate cleaning cartridges and properly formatted data cartridges.

A unique feature of Ultrium tape cartridges is LTO-Cartridge Memory (LTO-CM). LTO-CM is an intelligent memory chip embedded into the cartridge. It uses a radio frequency interface that eliminates the need for a physical power or signal connection between the cartridge and drive. Information normally stored in the header at the beginning of the tape is contained in the LTO-CM, including identification and usage information such as the number of times the cartridge has been loaded, when it was last cleaned, and error logs.

See the following sections for information on:

- Maintaining Ultrium Cartridges
- Write-Protecting Ultrium Cartridges
- Using Ultrium Cartridge Bar Code Labels
- Loading Ultrium Cartridges into a Magazine
- Using Ultrium Cleaning Cartridges

In addition to the information provided in this manual, you may also want to refer to the documentation provided with your Ultrium media.

Maintaining Ultrium Cartridges

Make it a practice to visually inspect your tape cartridges when loading or removing them from your tape library or autoloader. Taking a few minutes to check the condition of your cartridges will lower the risk of repeated failures and help ensure uninterrupted backup.

For general precautions when using tape cartridges, see page 1-7. In addition, do not apply more than one label onto Ultrium cartridges, as extra labels can cause the cartridges to jam in the tape drive.

CAUTION

Do not bulk erase Ultrium formatted cartridges. This will destroy pre-recorded servo information and make the cartridges unusable.

Write-Protecting Ultrium Cartridges

Each cartridge has a sliding write-protect switch. Using the write-protect switch ensures data safety for files that have been previously written to tape, preventing additional files from being written to that tape.

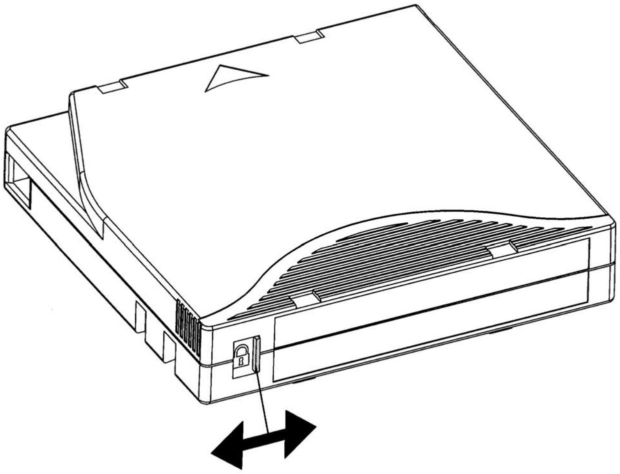
To change the write-protect setting, slide the red tab on the base of the cartridge (Figure 4-2 on page 4-6):

- **Right** to *prevent* data from being written to the cartridge. The red tab on the cartridge displays a padlock when the write-protect switch is in the "ON" position.
- **Left** to *allow* data to be written to the cartridge (unless the tape is write-protected electronically through your backup software). The padlock on the red tab cannot be seen and the hole is exposed when the write-protect switch is in the "OFF" position.

NOTE

With the write-protect switch in either position, data can be read from the cartridge.

Figure 4-2 **Ultrium Write-Protect Button Settings**



Using Ultrium Cartridge Bar Code Labels

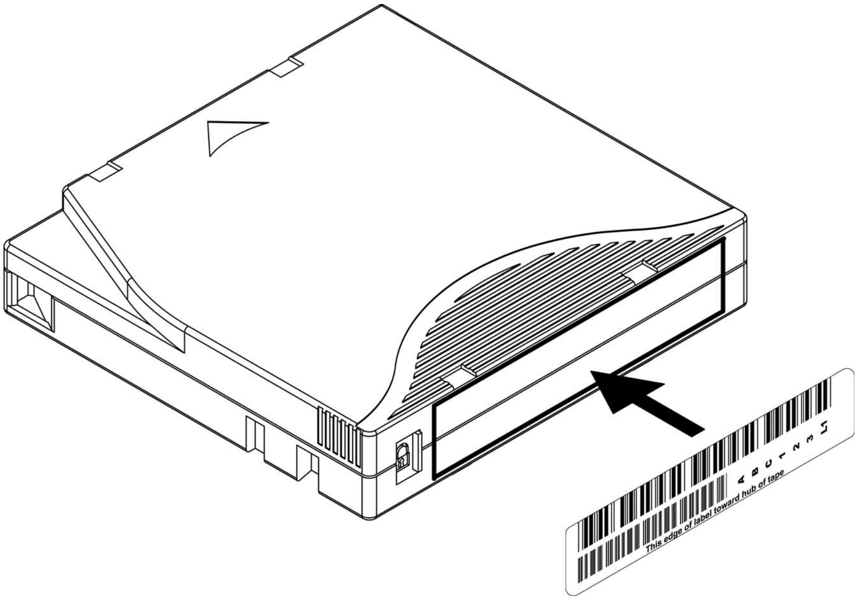
Make it a practice to use bar code labels on your tape cartridges. Your host software may need to keep track of the following information and the associated bar code:

- Date of format or initialization
- Cartridge owner (such as a group or department)
- Storage purpose

TIP If the host software does not keep track of this information, create a method for doing so.

Ultrium cartridges have a recessed area located on the face of the cartridge next to the write-protect switch. Use this area for attaching the bar code label (Figure 4-3). Do not apply labels onto the cartridge except in this designated area.

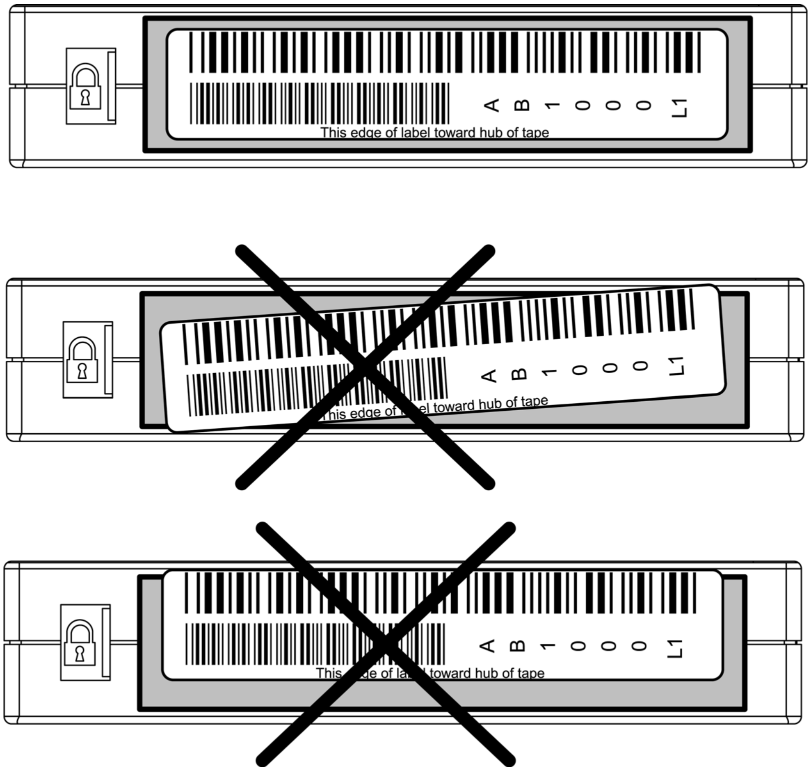
Figure 4-3 **Ultrium Cartridge Recessed Area**



CAUTION The bar code label should be applied with the alphanumeric portion facing the hub side of the tape cartridge (Figure 4-3 on page 4-7). Never apply multiple labels onto a cartridge, as extra labels can cause the cartridge to jam in a tape drive.

To ensure successful operation of your storage device, place the bar code label *entirely* within this area, ensuring that no part of the label is outside of the recessed area (Figure 4-4).

Figure 4-4 **Proper Ultrium Label Position**


A B 1 0 0 0 L1
This edge of label toward hub of tape
A B 1 0 0 0 L1
This edge of label toward hub of tape
A B 1 0 0 0 L1
This edge of label toward hub of tape

NOTE You can order additional bar code labels if needed. Bar code label ordering information is provided with your tape library or autoloader.

Table 4-3 **Ultrium Cartridge Bar Code Specifications**

Description	Specification
Data Cartridge Message	8-character: 6 alphanumeric (user preference) followed by 2 alphanumeric (media ID)
Cleaning Cartridge Message	8-character: ‘CLN’, ‘H’, 2 numeric, and 2 alphanumeric (media ID)
Dimensions	7.8 cm x 1.7 cm (3.07 in x 0.67 in)
Symbology	code 39 without check digit
Start/Stop Characters	*/*
• Short Bar • Long Bar	• 6.0 mm (0.24 in) • 8.5 mm (0.33 in)
Ratio	2.75:1
Print Quality	ANSI Grade “A”

NOTE For data cartridge messages, ‘n’ represents the volume serial number (or volser), and ‘XY’ represents the media ID. The HP Ultrium media ID is ‘Lg’ where ‘g’ (alphanumeric) designates a generation of the cartridge. For example, the HP Ultrium media ID for first generation data cartridges is ‘L1”.

For cleaning cartridge messages, ‘CLN’ denotes that it is a cleaning cartridge, ‘H’ represents Hewlett-Packard as the drive manufacturer, ‘n’ is the volume serial number, and ‘XY’ represents the media ID (as stated above). Bar codes will resemble ‘CLNHnnL1’.

Using Ultrium Cleaning Cartridges

HP Ultrium drives should only be cleaned if the *clean drive* icon displays on the tape library or autoloader status bar. Only use appropriately formatted data cartridges and HP Ultrium cleaning cartridges and follow the instructions in your tape library or autoloader user's guide. In general, replace cleaning cartridges after fifteen uses. Marking the label on the cleaning cartridge after each use will help you keep track of the number of uses.

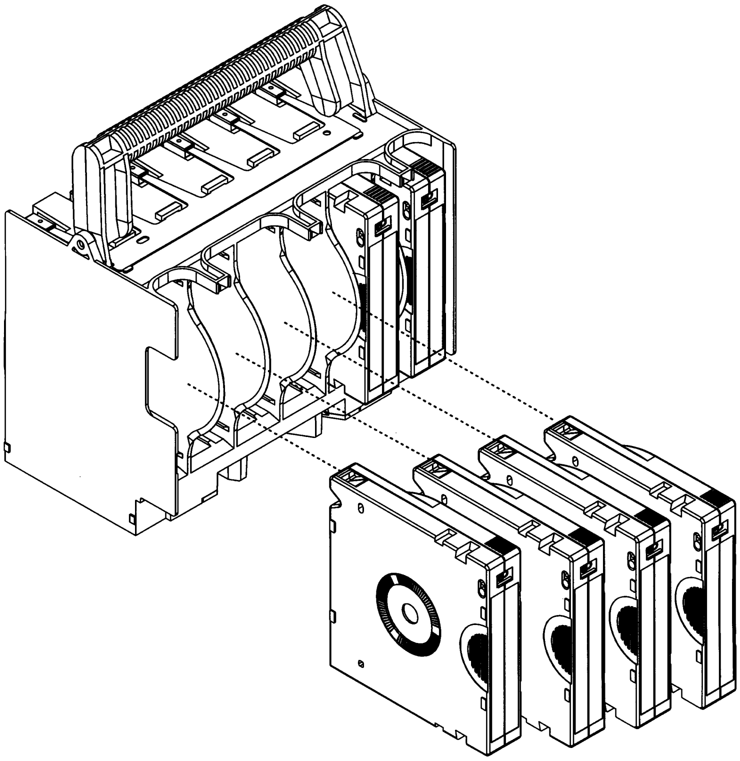
CAUTION Excessive use of the cleaning cartridge can cause unnecessary wear on the drive head. The tape library or autoloader front panel will display a message when the cleaning cartridge needs to be replaced.

See "Ultrium Cleaning Issues" on page 4-13 for information on troubleshooting common cleaning problems.

Loading Ultrium Cartridges into a Magazine

When inserting Ultrium cartridges into the tape library or autoloader magazine, ensure that each cartridge is positioned with the write-protect switch facing out of the magazine and towards the magazine handle (Figure 4-5). Push the tape into the slot until it “clicks” into place.

Figure 4-5 **Loading Tapes into a Magazine**



NOTE

The six-slot magazine depicted in Figure 4-5 is for an autoloader. The tape library magazine has five slots.

Troubleshooting HP Ultrium Drives

This section describes troubleshooting information for Ultrium drives, including:

- Rewinding/Removing a Stuck Tape
- Ultrium Cleaning Issues
- LTO-Cartridge Memory (LTO-CM) Issues

Refer to your tape library or autoloader user's guide for information on troubleshooting performance issues or other problems you may encounter. If you experience problems not covered by these manuals, contact your support representative.

NOTE For information on upgrading drive firmware, see your tape library or autoloader user's guide.

Rewinding/Removing a Stuck Tape

If a tape gets stuck in the drive, attempt to eject the tape using:

- Tape library or autoloader front panel
- Remote management card Web-Based Library Administrator pages
- Host backup software

If these attempts are not successful, contact your support representative.

Ultrium Cleaning Issues

Table 4-4 describes potential issues with cleaning cartridges and how to resolve them.

Table 4-4 **Ultrium Cleaning Issues**

Problem	Solution
Recurring cleaning message.	• If the message reappears after cleaning the drive, the front panel display will indicate the need to replace the cleaning cartridge. • Replace the existing cleaning cartridge with a new one. • If the message reappears when a particular data cartridge is used, verify that the data cartridge is readable by: — Clearing the error message. — Reading the tape again. • If the data cartridge can be read, backup data from the damaged cartridge to another cartridge, and discard the damaged one.
A brand new data cartridge is used and the *clean drive* icon is displayed.	• Clean the outside of the data cartridge using a damp cloth. • Clean the drive using the drive cleaning procedure in your tape library or autoloader user’s guide. • If the icon is displayed again within a short amount of time, replace the data cartridge.
Cannot load the cleaning cartridge.	• Ensure the cleaning cartridge matches your drive type. Cleaning cartridges are unique for each drive technology.

LTO-Cartridge Memory (LTO-CM) Issues

The LTO-CM stores information that is normally stored in the header at the beginning of the tape, including identification and usage information such as the number of times the cartridge has been loaded, when it was last cleaned, and error logs. If the LTO-CM becomes damaged, you may experience difficulty with the cartridge.

Table 4-5 **LTO-CM Issues**

Problem	Cause	Solution
A new data cartridge that is write-enabled is rejected by the drive.	LTO-CM has failed or is damaged.	Replace data cartridge.
A new data cartridge that is write-protected is rejected in multiple known good drives.	LTO-CM has failed and the drive has found no data to recover.	Replace data cartridge.
A cartridge that has data written to it and is write-enabled is rejected by the drive.	LTO-CM has failed or is damaged.	The data can still be recovered. Contact your support representative for more information. After data recovery, replace the cartridge.
A cartridge that has data written to it and is write-protected restores very slowly.	LTO-CM has failed and the drive cannot use the tape directory information to recover the data.	The data can still be recovered but may take longer than normal.

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